NASA SensorWeb: From v2.0 to v3.0
Workflows and WCPS for Space Applications

Open Geospatial Consortium  TC Meeting
Workflow & Coverages Working Groups
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Pat Cappelaere (Vightel)
Dan Mandl (GSFC)
Stu Frye (SGT)
Agenda

• Our Standard Compliance Evolution
• v2.0 Accomplishments & Lessons Learned
• v3.0 Architecture Migration
  – Towards A Unified Interface
  – Examples
Big Software Project: Cost is $f(\text{code})$
Our Reality...

Funding

2005 ... 2010
But we have made some good progress...
Number of OGC Standards Has Increased Significantly

which would increase our cost!

2005 ... 2010

# OGC Standards
So Our OGC Compliance Has Significantly Decreased

OGC Compliance

2005 ... 2010
v2.0 Architecture
NASA SensorWeb 2.0

SPS

GetFeasibilities
SubmitTask

Orbit/STK

EO-1
ASTER
FORMOSAT
SPOT...

Sensor Planning Service
You've Got Data

You've Got Data

Web Notification Service
NASA SensorWeb 2.0

SPS

You’ve Got Data

Task

GetFeasibilities
SubmitTask

Orbit/STK

EO-1
ASTER
FORMOSAT
SPOT...

Publish/Subscribe Basic Service
NASA SensorWeb 2.0

Sensor Observation Service

SPS

GetFeasibilities
SubmitTask
OPSB
SOS

Stream

Orbit/STK

EO-1
ASTER
FORMOSAT
SPOT...

Raw Data (L1R, L1G)

Data
GeoTorrent Service
NASA SensorWeb 2.0

SPS

GetFeasibilities
SubmitTask
OPSB
GeoTorrent

Orbit/STK

EO-1
ASTER
FORMOSAT
SPOT...

Data

WPS

(JPL, NG...)

Composite
Burnscar...

Task
Derived Products

Web Processing Service
WCPS: A SQL-like Query Language

```python
for c in (NIR)
    return
    encode(
        (char) ((c.0 / ((float)c.0 + c.1)) - (c.1 / ((float)c.0 + c.1))) > 0.6) * 255,
        "png")
```
define name: flow1
task_eo1
process_alinotify_user
end
v2.0 Lessons Learned

- Too Many Ways to Do Similar Things
  - Execute Task, Process, Workflow, Algorithm...
  - Hard Learning Curve on Users and Implementors
- Two Languages:
  - For Workflows and Algorithms Developments
- What About Web Service Security?
SEXP?
S-Exp or Symbolic Expressions

Think LISP or Parse Trees

\( (= 4 (+ 2 2)) \)
Generic Onboard SWAMO Agent

Create/Update

Execute

Security

2-factor Auth

Create/Update

Text

Visual

Domain Specific Language (DSL)

Flows

Algorithms

Ruby

GDAL

RMagick

Data

SEXP

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DSL Example

define name:‘ali_l1g_visible’, author:‘Pat C.’, revision:1.0
scene asset:EO1, instrument:‘ALI’, data:‘L1g’
  b5 = band(5)
  b4 = band(4)
  b3 = band(3)
  mask = b5 > 0
composite_image red:b5, green:b4, blue:b3, alpha:mask
  stretch percent:2
  compression quality:50  # 0 to 100, 100% being highest quality
  encode type:‘jpg’      #could do tif, png, kmz
end
end
end
define name:'ali_ndvi', author:'Pat C.', revision:1.0
scene asset:EO1, instrument:'ALI', data:'L1g'
  b7 = band(7)
b5 = band(5)
  mask = b7 > 0 and b5 > 0
normalized_difference_ratio first:b7, second:b5
    stretch percent:2
    colorize map:'prism'
    compression quality:50  # 0 to 100, 100% being highest quality
    encode type:'kmz'  #could do tif, png, jpg, kmz
end
end
end
NASA SensorWeb v3.0

Notifications
Data Atom Feed
GetMetadata
Execute Task
GetFeasibilities
Execute Workflow
Data Atom Feed
Execute Process
Custom Products
Execute Algorithms
Custom Products
2-Factor Auth

Data

EO-1 HyspIRI Testbed

Feature Server Profile
Tasking Profile
Workflows Profile
Processing Profile
Coverage Processing Profile

GetFeasibilities
SubmitTask
Flows
Composite
Algorithms

Security / OpenID / OAUTh

Distributed Security Providers

Other Nodes
Security